



Faculty of Technology and Science
Mathematics

Syllabus

Course Approval

The syllabus was approved by the Faculty Board of Technology and Science on 29 June 2011, and is valid from the Spring semester of 2012 at Karlstad University.

Course Code: MAAD02

Kinetic Theory, 7.5 ECTS Credits

(Kinetisk teori, 7.5 Swedish credit points)

Degree Level: Master

Progressive Specialisation: A1N (Second cycle, has only first-cycle course/s as entry requirements)

Language of Instruction

English

Prerequisites

Multidimensional calculus, 7,5 ECTS cr, Advanced calculus, 7,5 ECTS cr, and Complex Analysis, 7,5 ECTS cr, or equivalent, and skills equivalent to at least 75 ECTS credits of mathematics courses at the Bachelor's level.

Major Field of Study

MAA (Mathematics)

Learning Outcomes

Upon completion of the course the student should be able to:

- write down the Boltzmann's and Landau's kinetic equations;
- prove the main conservation laws for the Boltzmann's and Landau's kinetic equations;
- prove the Boltzmann H-theorem;
- prove the main properties of the linear Boltzmann equation;
- derive the linear Boltzmann equation from Newton's N-particle dynamics;
- write down the Euler and Navier-Stokes equations of hydrodynamics;
- derive the Euler and Navier-Stokes equations of hydrodynamics from the Boltzmann equation;
- derive the Liouville equation (conservative and non-conservative) from N-particle dynamics;
- evaluate moments of the solution to the spatially homogeneous Maxwell-Boltzmann equation

Content and Form of Instruction

- N-particle dynamical systems and distribution functions; Conservative and non-conservative systems
- Kinetic equations; Derivation of the Boltzmann equation
- Main properties of the linear Boltzmann equation
- Nonlinear Boltzmann equation and Landau equation
- Main properties of nonlinear kinetic equations (conservation laws and H-theorem)
- Boltzmann equation and hydrodynamics
- Methods of Chapman-Enskog and Hilbert
- Spatially homogeneous Maxwell-Boltzmann equation

Reading List

See separate document.

Examination

Assessment is based on a written hand in assignment and an oral exam. The number of examination opportunities is limited to three per academic year.

Grades

One of the grades U (Fail), G (Pass), or VG (Distinction) is awarded in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course assessment is based on student views and experiences as reported in written course evaluations and/or group discussions. Students will be informed of the result of the evaluation and of the measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional Information

Students who enrolled before 1 July 2007 will complete their studies in accordance with the requirements of the earlier admission. Upon completion students may request degree and course certificates to be issued under the current ordinance if they meet its requirements.

The local regulations for studies at the Bachelor's and Master's levels at Karlstad University stipulate the obligations and rights of students and staff.

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